

Management Tools to Increase Dairy Cow Feed Efficiency

V.E. Cabrera and A. Kalantari
University of Wisconsin-Madison Dairy Science

[Home](#)[Tools](#)[Projects](#)[Publications](#)[Presentations](#)[Links](#)

Helping dairy farms improve economic performance

This site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly computerized decision support tools to help dairy farmers improve their economic performance along with environmental stewardship.



UW-Dairy Management
Decision Support TOOLS

University of Wisconsin

[University of Wisconsin - Madison](#)[UW - Cooperative Extension](#)[UW - Dairy Science](#)[Dairy Cattle Reproduction](#)[Dairy Cattle Nutrition](#)[Milk Quality](#)[UW Dairy Nutrient](#)[Understanding Dairy Markets](#)[UW Center for Dairy Profitability](#)

Latest Projects

[Improving Dairy Farm Sustainability](#)[Genomic Selection and Herd Management](#)[Dairy Reproduction Decision Support Tools](#)[Strategies of Pasture Supplementation](#)[Improving Dairy Cow Fertility](#)

Contact



Associate Professor
Extension Specialist
in Dairy Management
279 Animal Sciences
1675 Observatory Dr.
Madison, WI 53706
(608) 265-8506
vcabrera@wisc.edu
[More »](#)

Victor E.Cabrera, Ph.D.




Helpful Link

[Repro Money Program](#)

Tweets


[Follow](#)

UW-Madison 
[@UWMadison](#)

11 Apr

Drop everything, this time-lapse will make you want to shout from the mountaintops, "I love Madison!" youtu.be/_8cGpJARTvw

↕ Retweeted by Victor E. Cabrera

 Show Media




Victor E. Cabrera
[@vecabrera](#)

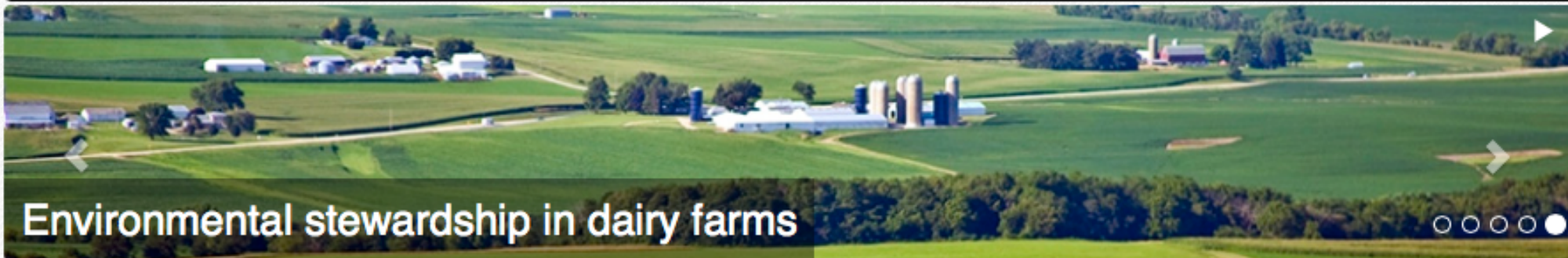
18 Mar

wisc.edu fb.me/6KXw7HsFF

Tweet to [@vecabrera](#)

 Share



[Home](#)[Tools](#) ▾[Projects](#)[Publications](#)[Presentations](#)[Links](#)

Tools

A collection of the state-of-the-art and scientific-based dairy farm management decision support tools that are user-friendly, interactive, robust, visually attractive, and self-contained. These tools count with associated documentation and video demonstrations. Technical support on their application is also available upon request.

Feeding

[> FeedVal 2012](#)[> Grouping Strategies for Feeding Lactating Dairy Cattle](#)[> Nutritional Grouping in Wisconsin and Michigan Dairy Farms](#)[> Optigen® Evaluator](#)

Heifers

Reproduction

Genomics

Production

Replacement

Health

Financial

+40 Decision Support Tools

Feeding all lactating cows equally

A larger number of cows are overfed

Same ration (TMR) to all cows (groups)

All lactating cows receive same nutrient density diet



Preferred “high” rations

Low producing animals receive more nutrients than required

One diet for all

Would never optimize production and efficiency

Considering nutritional grouping

For improved feed efficiency

Opportunity to increase productivity

Cows receive more precise diets

Improved profitability

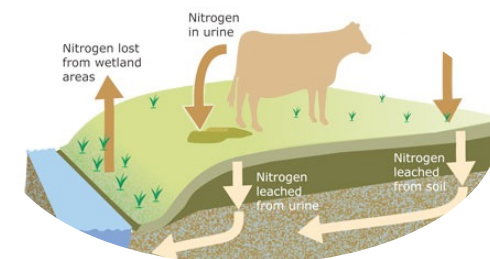
IOFC gains far exceed additional expenses or losses

Diets closer to requirements

Saves feed costs and increases income over feed costs

Additional benefits

- ↓ environmental concerns
- ↑ health conditions



Why farmers do not group more?

Trying to find most important constraints

2-page mailed survey

The image shows two pages of a survey form. Page 1, titled 'A. BASIC DAIRY FARM INFORMATION', contains sections A.1 through A.7. A.1 asks for the number of dairy cattle. A.2 asks for milk production. A.3 asks for the primary manager. A.4 asks for the role of the nutritionist. A.5 asks if the farm is managed predominantly as a pasture-based system. A.6 asks if the farm is certified organic. A.7 asks for the primary housing facility for lactating cows. Page 2, titled 'B. FEEDING & RATIONS FOR LACTATING COWS', contains sections B.1 through B.5. B.1 asks for the feeding system. B.2 asks for the number of different rations. B.3 asks for the reasons for not feeding more rations. B.4 asks for the reasons for not feeding more rations. B.5 asks if the farmer would consider becoming a demonstration farm.

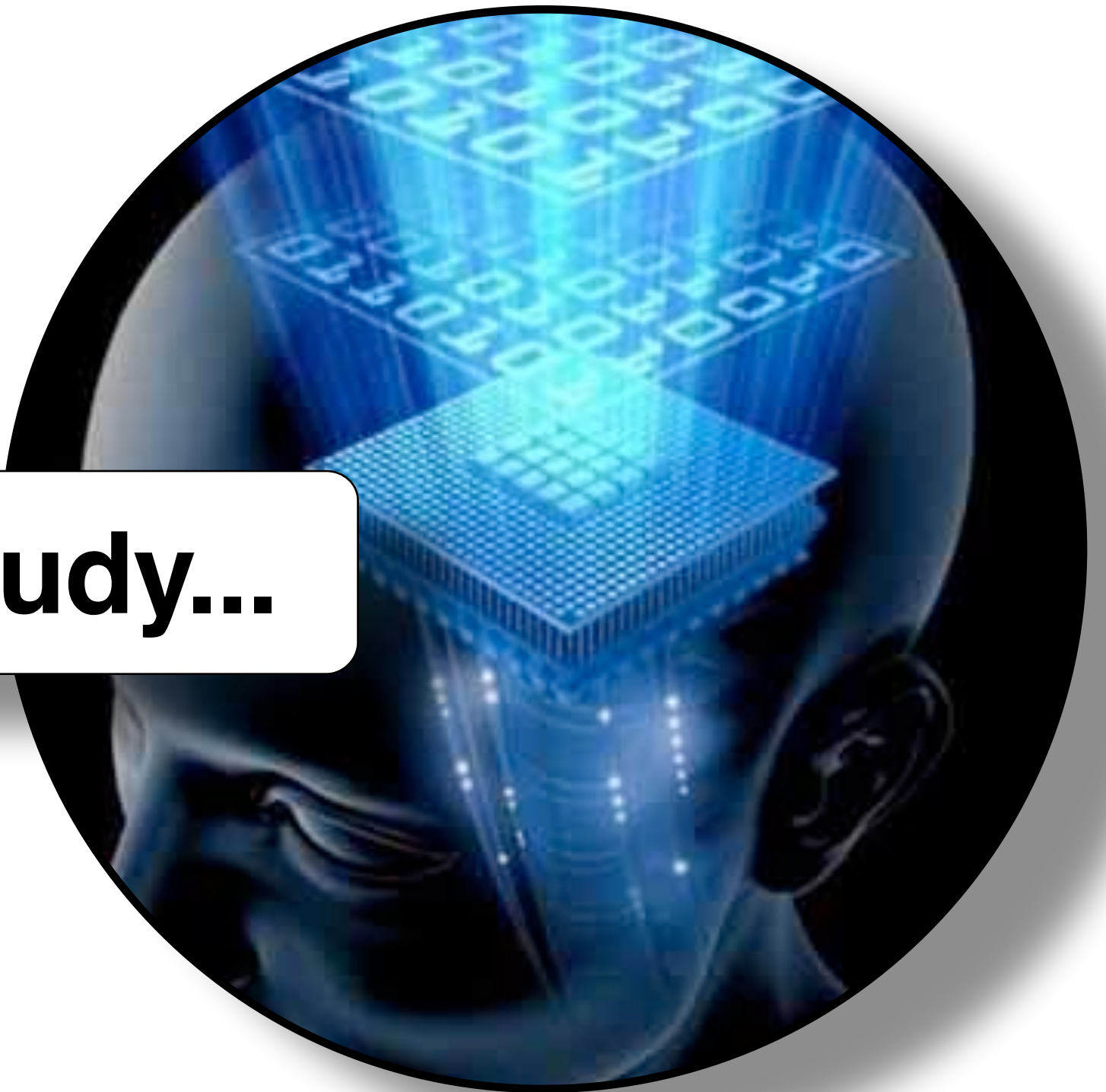
Constraints to feeding more ration groups

1. Milk drops when cows are moved
2. Desire to keep management simple
3. Conflicts with grouping for reproduction
4. Farm facilities do not allow it
5. Not enough labor or personnel to handle it

Results (responses)

- 196 WI farms
- 211 MI farms

A simulation study...



Strategies for grouping cows

Depend on farm and herd characteristics

Individual cow nutrient requirements

- Energy
- Protein (RUP, RDP, MP)

Number of lactating cows on the herd

States (i.e., current characteristics of the cow)

Farm characteristics

Capacity to handle
lactating feeding
groups



Adapted from McGilliard et al., 1983;
St-Pierre and Thraen, 1999

Milk (and components)

Cow-specific lactation curves

Milk based on

- Herd ME305
- Cow PPA or ME305
- Stochasticity

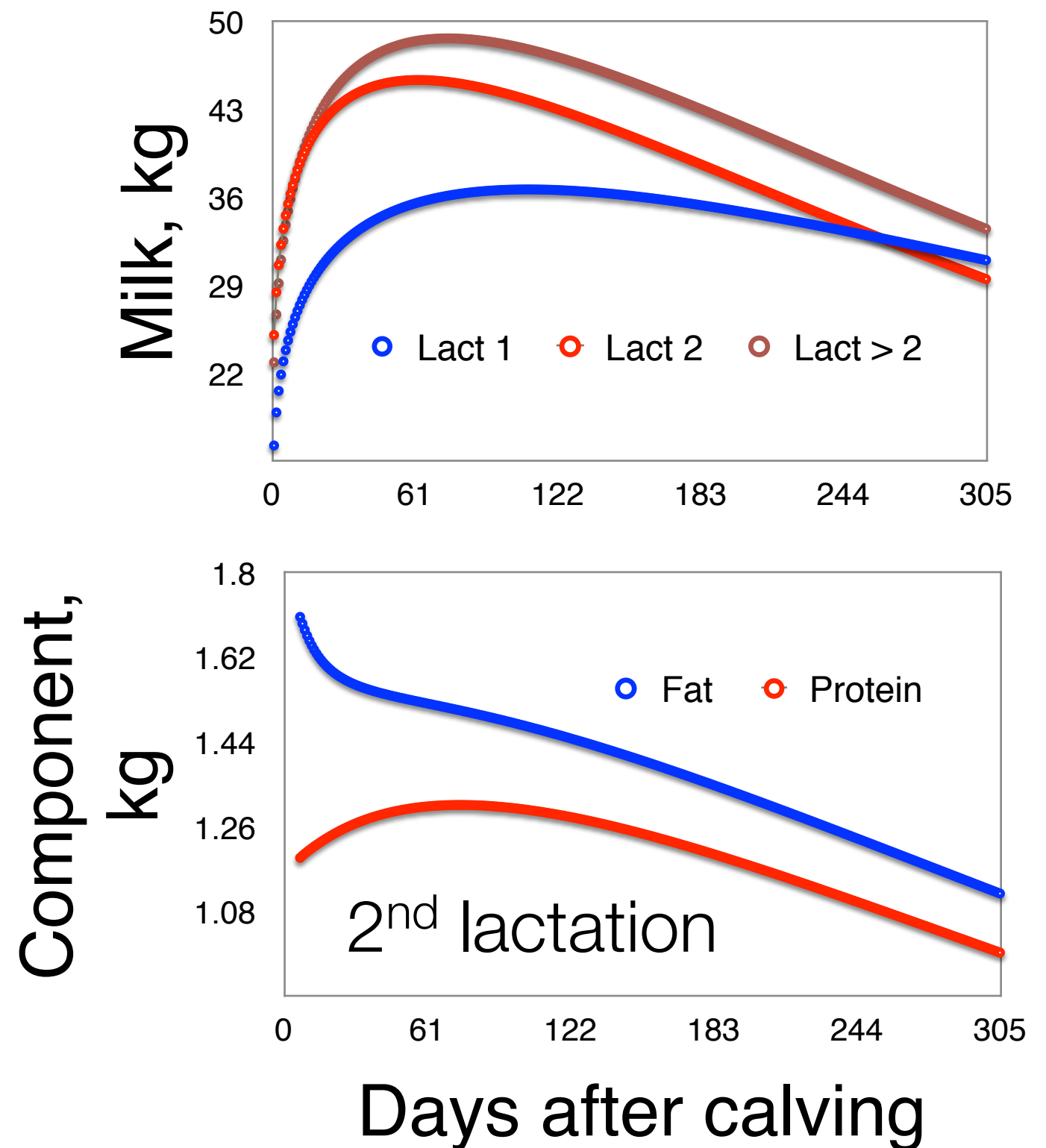
Components

- Herd
- Stochasticity

Base function

- Woods
- Adjusted Woods

De Vries, 2001



Initial individual cow BW

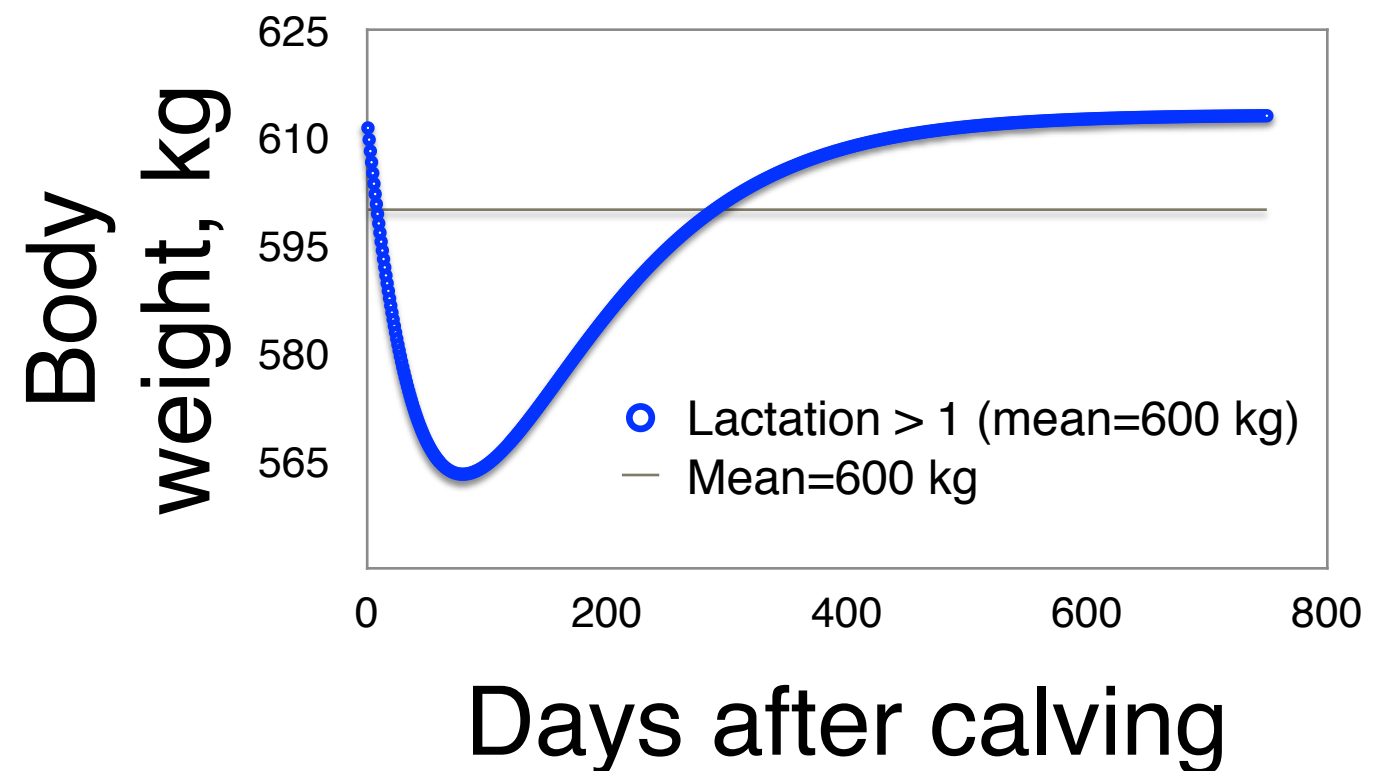
Cow-specific BW



Daily BW and BCS change according to:

- Lactation
- DIM
- Stochasticity

1. Available from farm records, or
2. Stochastic distribution

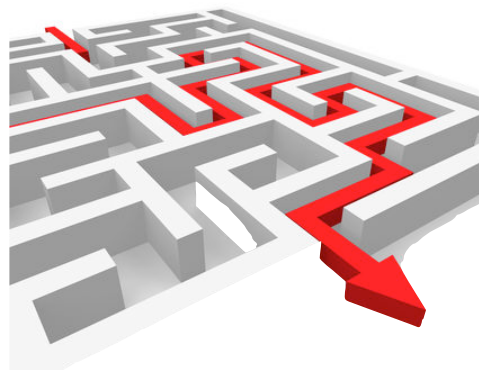


Criteria for nutritional grouping

Several criteria exist

Days after calving (DIM)

Based on stage of lactation



Fat (protein) corrected milk

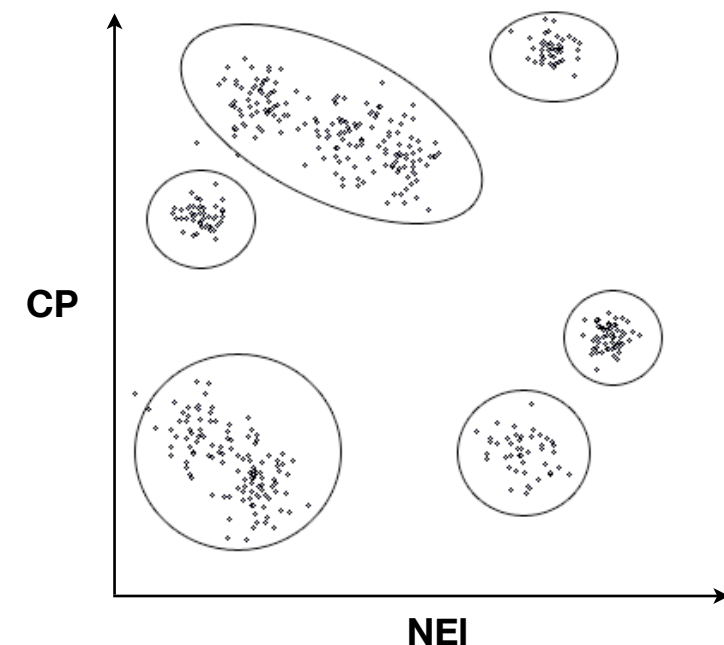
Based on level of production measured as F(P)CM

Dairy merit

Function of both F(P)CM and BW

Cluster

Seems to be MOST efficient criterion



McGilliard et al., 1983
St-Pierre and Thraen, 1999

Nutritional grouping

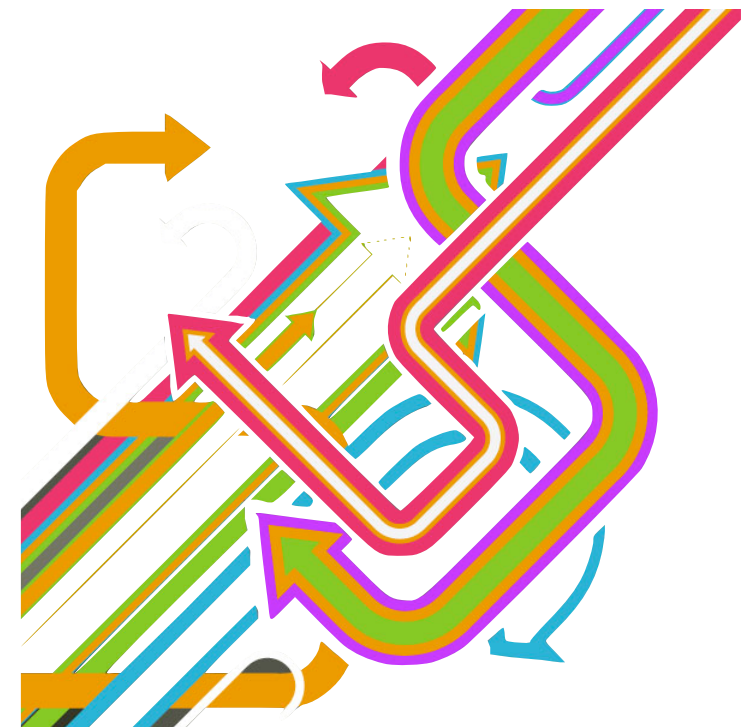
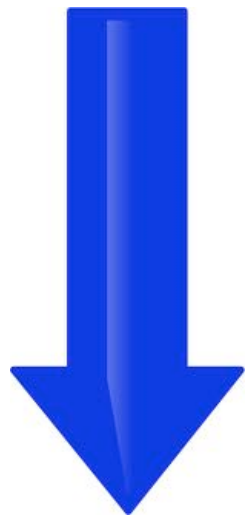
Two main types of groups

Obligated groups

- Fresh (< 22 DIM)
- Dry (~> 220 DCC)
- Daily assigned

Optional groups

- Actual additional groups
- Daily assigned
- Monthly re-grouped



Cow and herd simulation

Monte Carlo approach

Next event scheduling

- Pregnancy
- Abortion
- Dry-off
- Parturition
- Involuntary culling
- Death

Immediate replacement

- After a cow leaves the herd

Two-step

- 1. Binary outcome of event:
 - Happens or not
 - E.g., uniform distribution
- 2. DIM of the occurrence
 - When it happens
 - E.g., Weibull distribution

Replicates

- 1,000 replicates for each cow within specific herd

Cow simulation

Follows actual COW card

Variable	Unit	Description
Cow ID	#	Cow identification
Parity	#	Lactation
DIM	d	Days in milk, days after calving
DCC	d	Days in pregnancy (DIP)
Fat	%	Fat component on milk
Protein	%	Protein component on milk (%)
PPA*	%	Predicted producing ability
ME 305*	kg/305 d	Mature equivalent milk production
BW	kg	Live body weight

*Either PPA or ME305 used to assess cow's milk class. PPA preferred if available

Studied herds

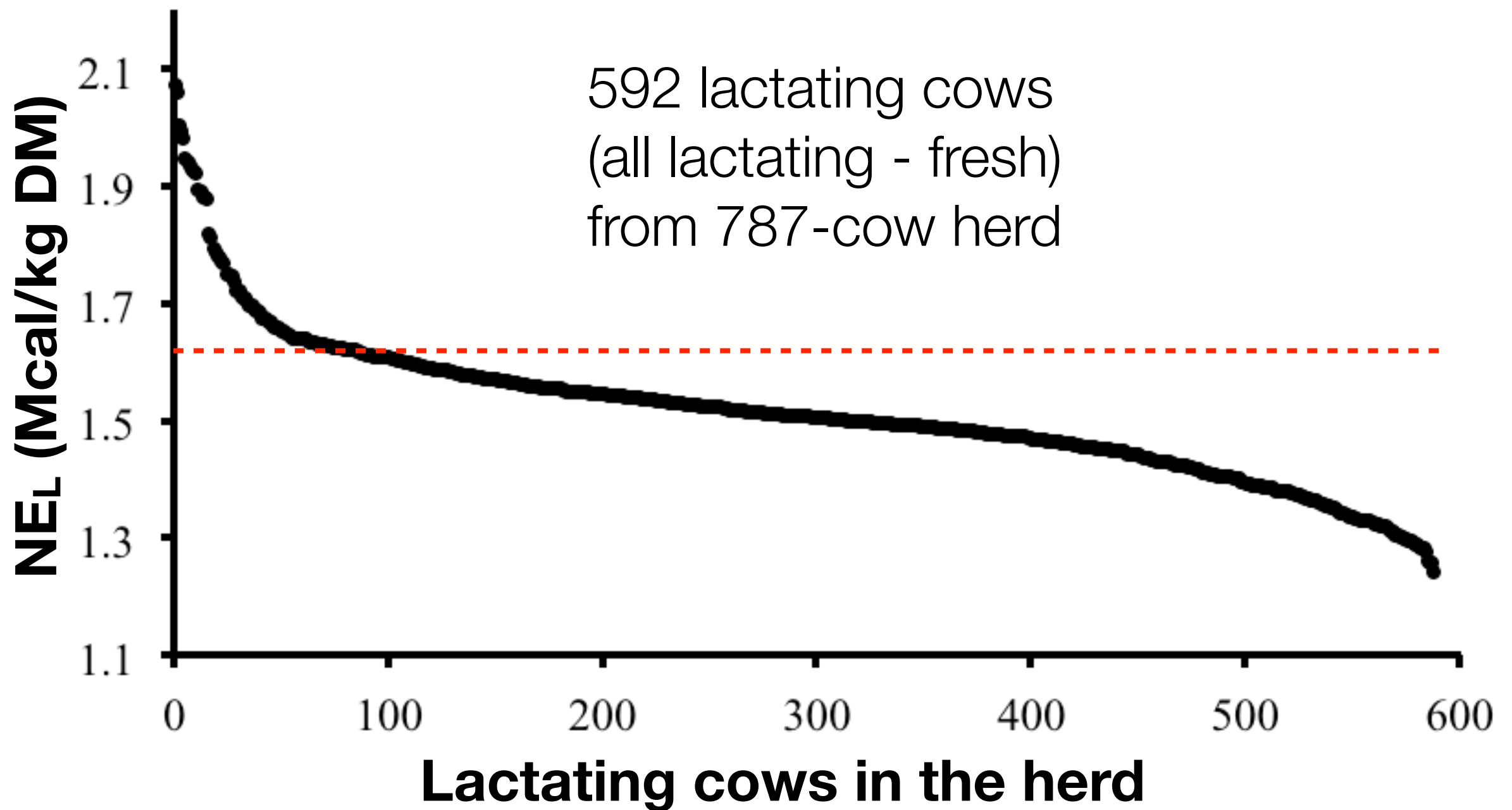
All data collected at the **cow-level**

Herd (size)	570	787	727	331	1460
Herd ME 305, kg	16,140	12,884	13,897	13,348	14,188
1st lactation, %	43	39	39	38	45
Average DIM	187	178	201	208	189
21-d PR, %	18	19	19	17	18
Culling risk, %	32	37	36	35	40
Abortion, %	7	11	11	16	7
BW available	<i>x</i>	<i>x</i>	✓	✓	<i>x</i>

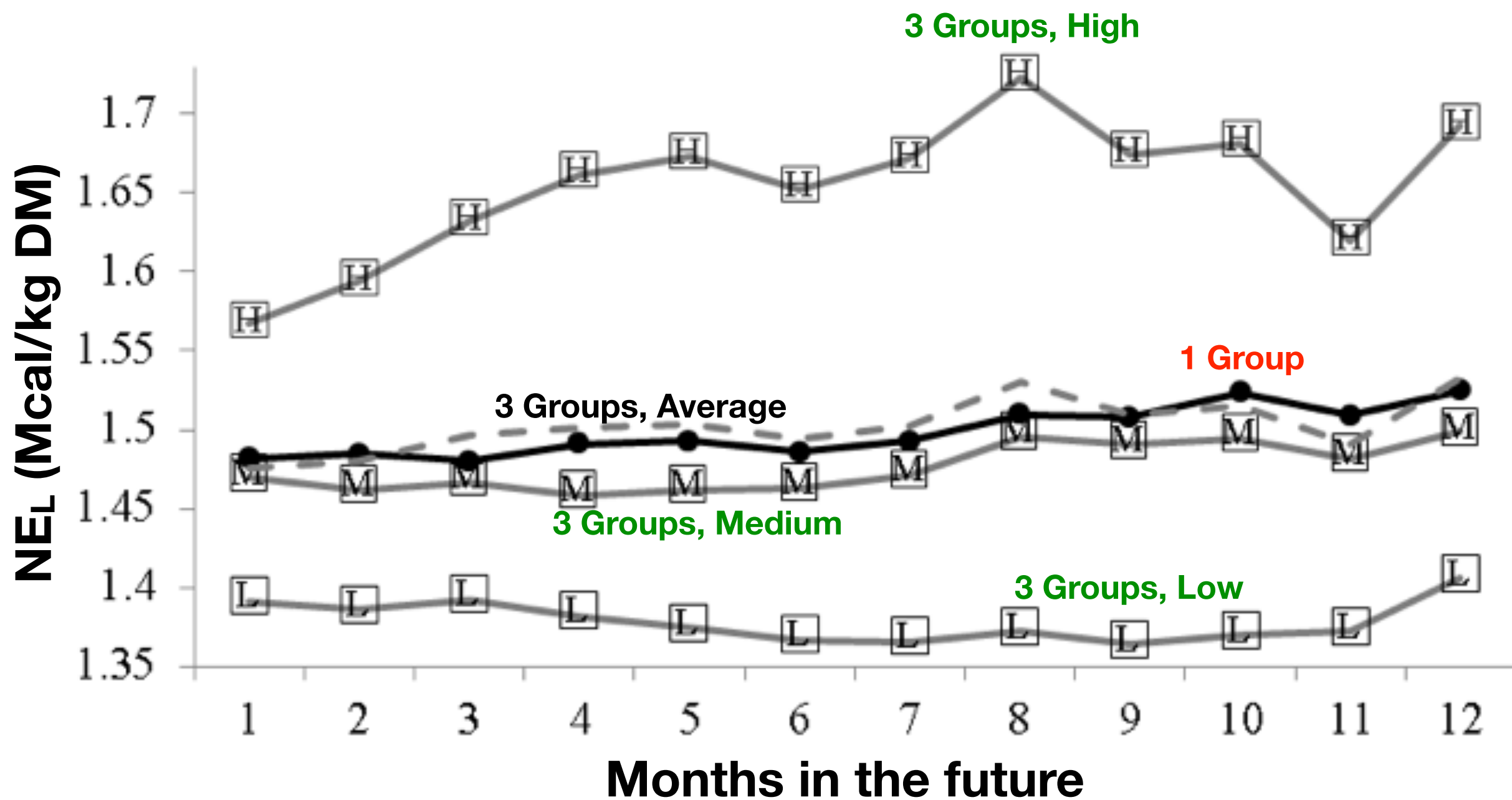
A graphic of a target with concentric purple and white rings. A blue 3D arrow is shown hitting the center bullseye. The target is set within a white hexagonal frame with a black outline and a soft shadow.

...And we are finding

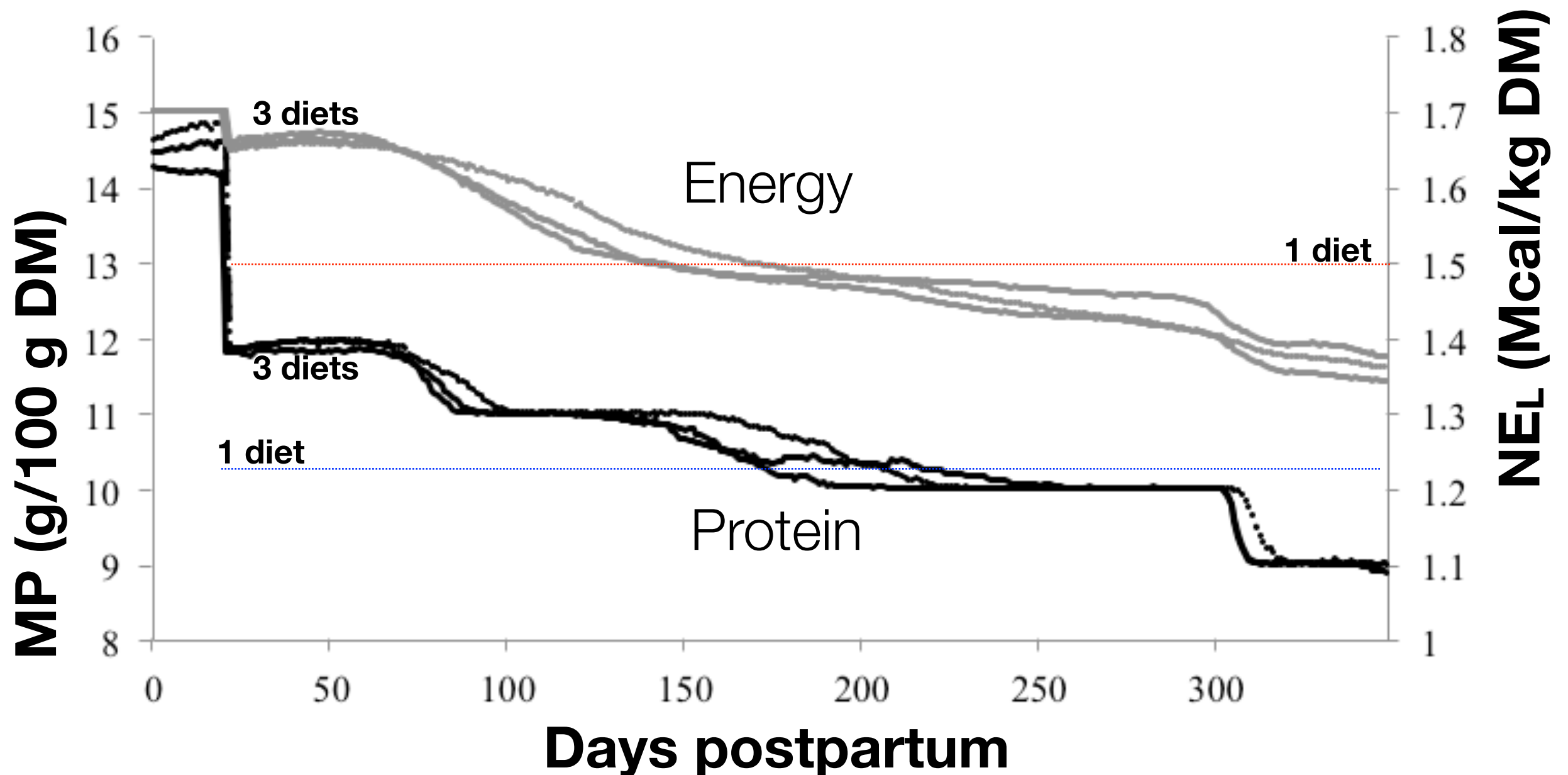
Energy requirements of cows



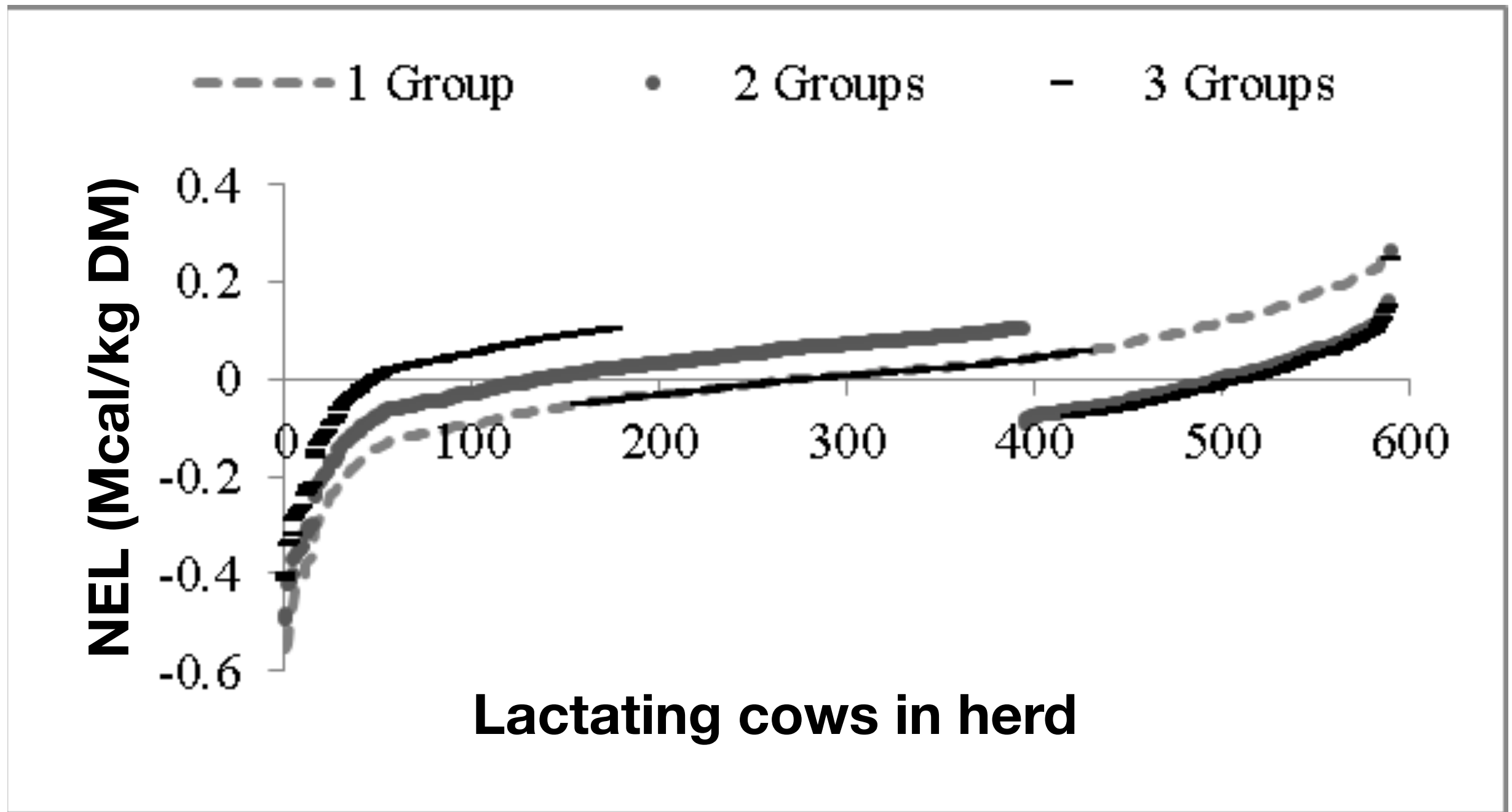
Energy provided in diets



Energy and Protein concentrations throughout Lactations (1, 2, ≥ 3)

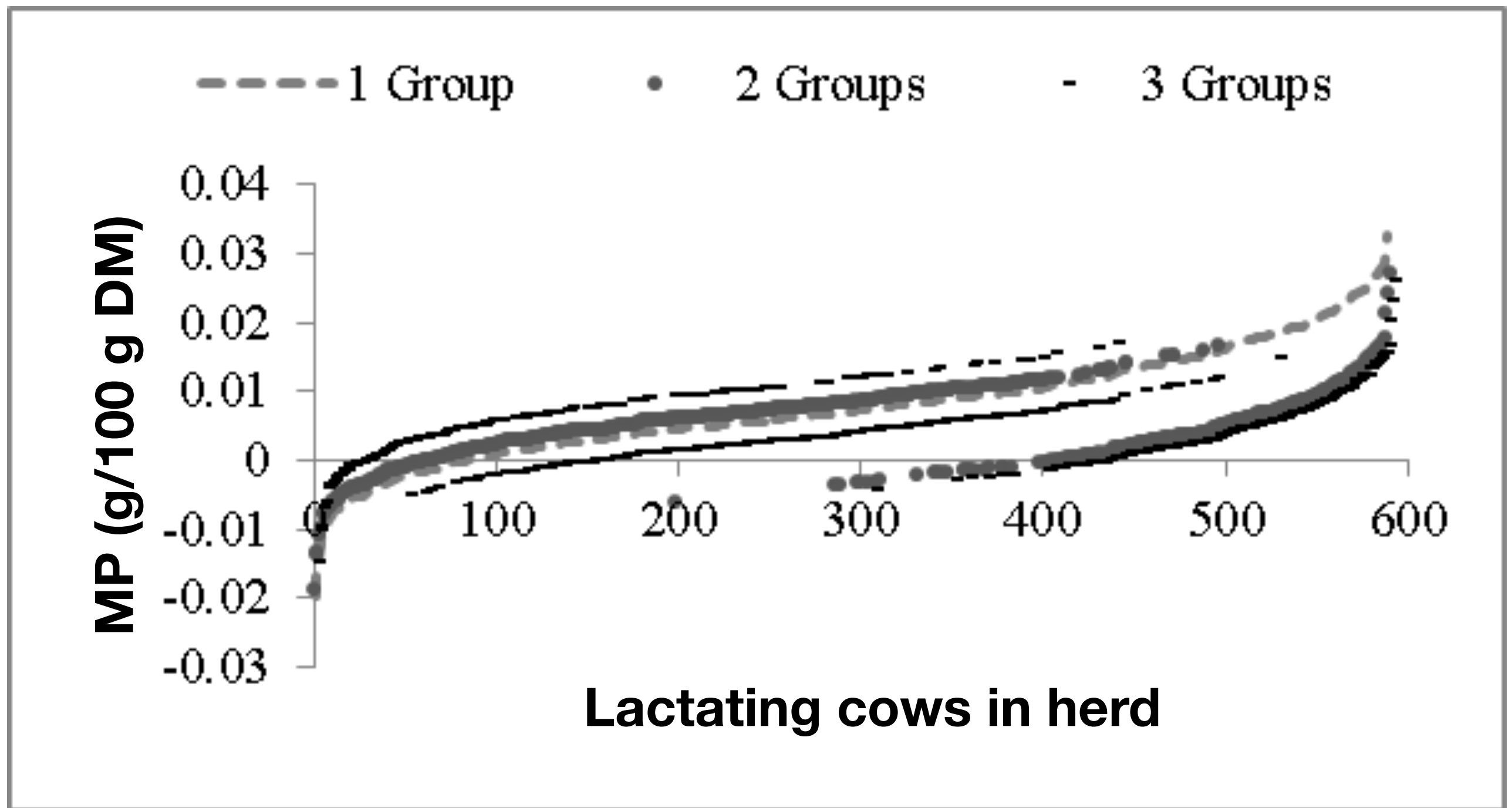


Provided - Required Energy in diet



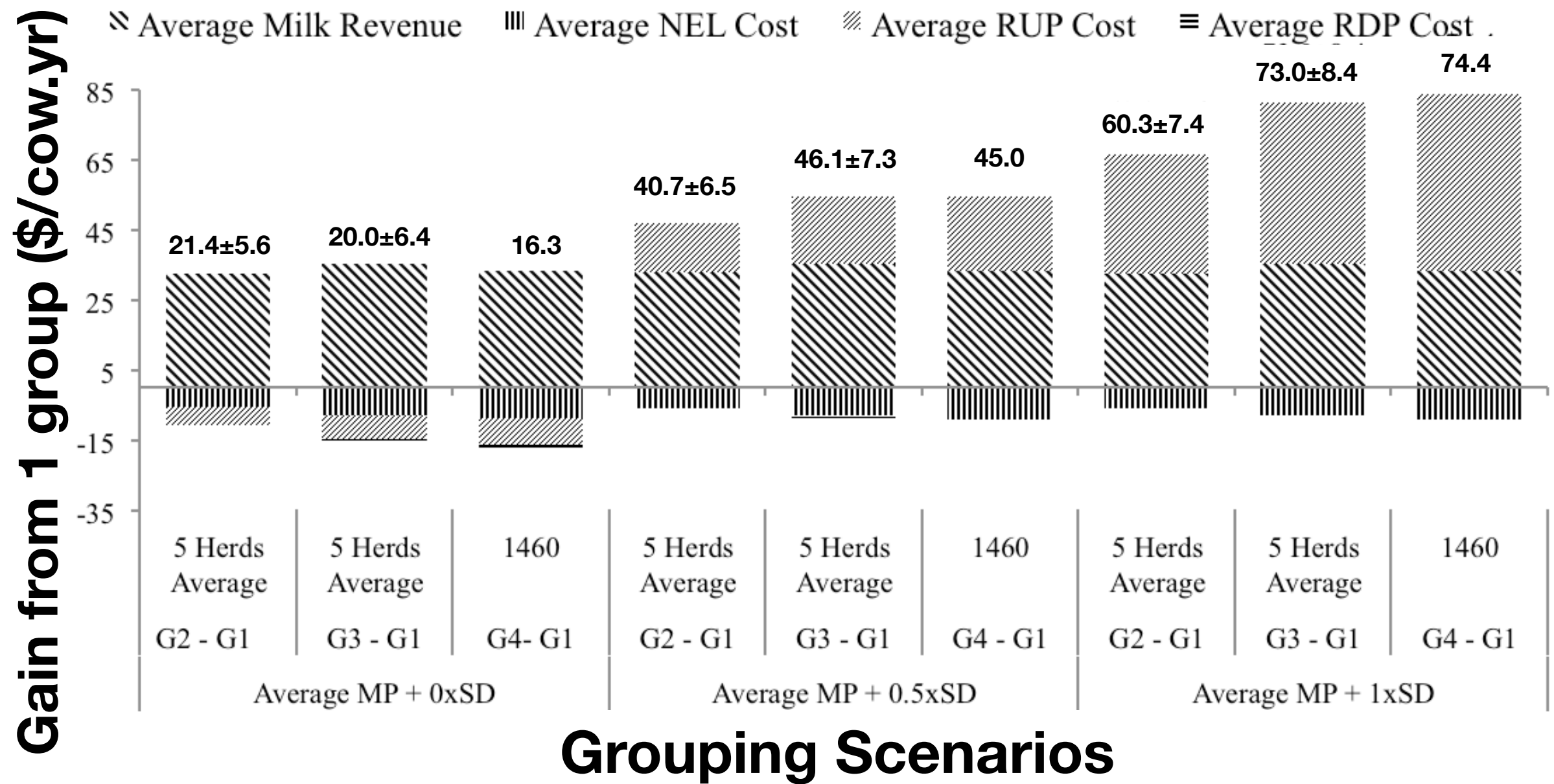
592 lactating cows (all lactating - fresh) from 787-cow herd

Provided - Required MP in diet



592 lactating cows (all lactating - fresh) from 787-cow herd

Average gain of grouping

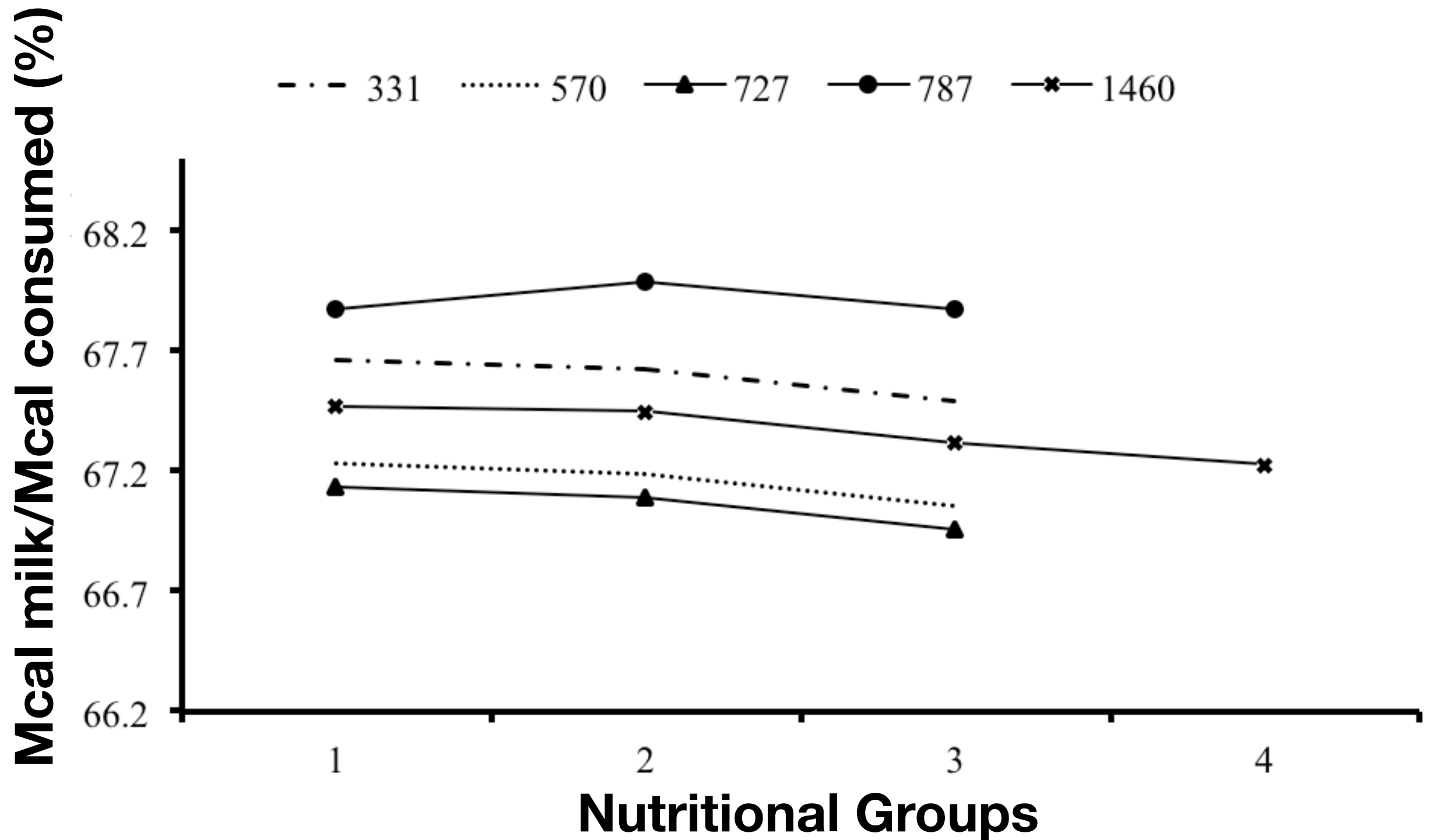


Economic Gain (\$/cow.yr)

Farm and Herd Size	Scenario	Difference between Grouping and 1 Group		
		2 Groups	3 Groups	4 Groups
331	base	53.54	65.91	-
	milk loss ¹	35.75	47.59	-
	1 st lactation ²	47.66	58.29	-
570	base	54.0	65.79	-
	milk loss ¹	37.59	44.82	-
	1 st lactation ²	43.28	53.45	-
727	base	62.72	74.98	-
	milk loss ¹	49.63	54.75	-
	1 st lactation ²	49.89	59.47	-
787	base	73.50	88.41	-
	milk loss ¹	57.53	67.39	-
	1 st lactation ²	61.80	74.64	-
1,460	base	57.57	69.96	74.45
	milk loss ¹	43.56	49.36	50.81
	1 st lactation ²	46.90	57.19	61.45

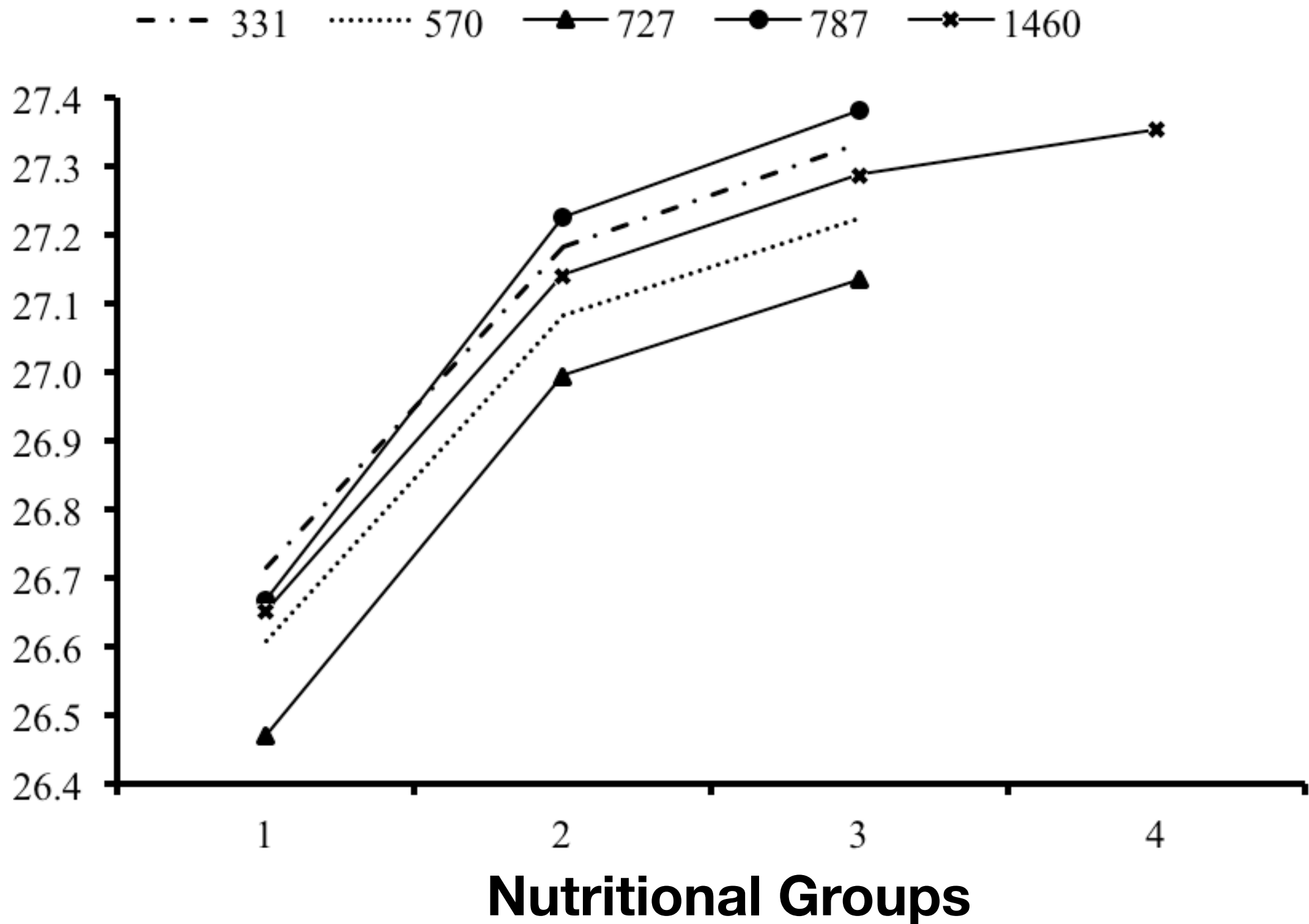
¹1.82kg x 5 d. ²1st lactation fed as a separate group

Energy captured in milk



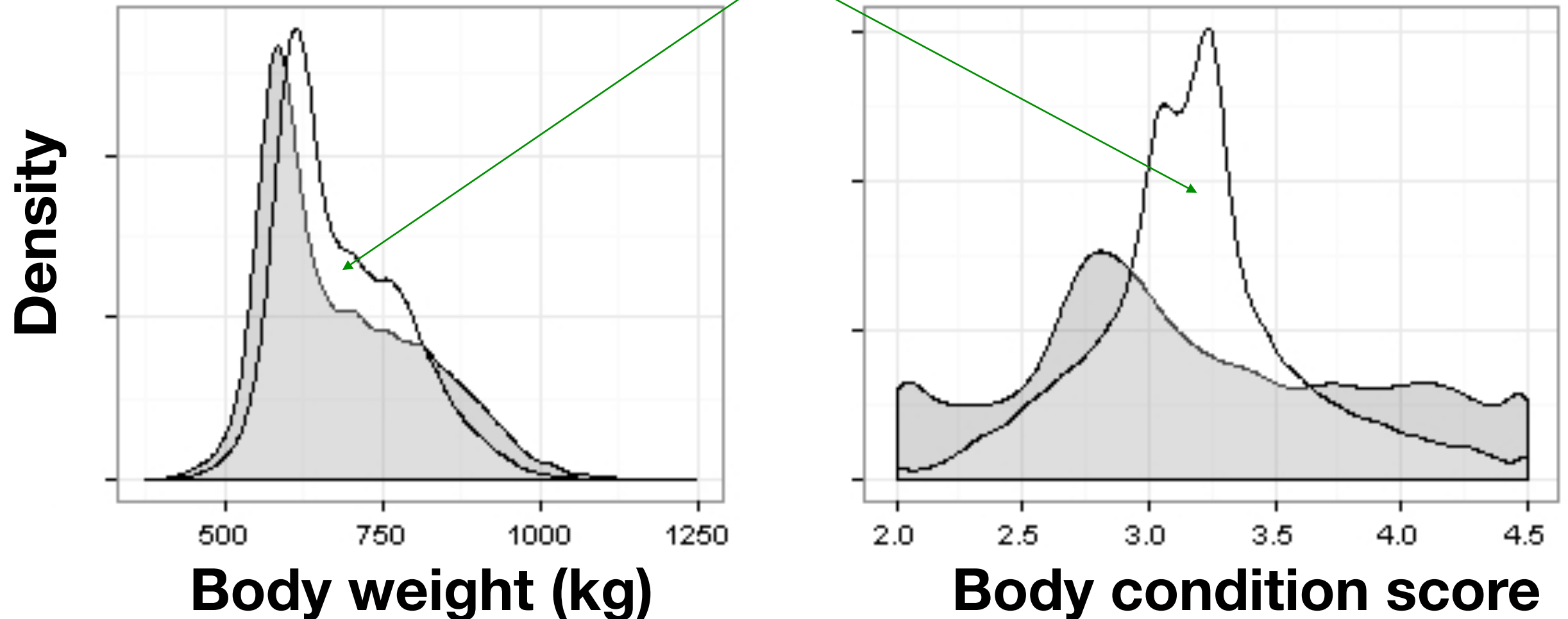
Nitrogen captured in milk

Milk N produced/Feed N consumed (%)



Body weight and BCS

3 nutritional groups



1,000 replicates for 787-cow herd

Total area under curves adds to 1



UW-Dairy Management
Decision Support TOOLS

Decision support tool...

<http://DairyMGT.info>

A simplified online tool

Herd-specific assessments (DairyMGT.info)

UW Dairy Management Tool

University of Wisconsin-MadisonUW ExtensionDairy ScienceContact

Grouping Strategies for Feeding Lactating Dairy Cattle

V.E. Cabrera, UW-Madison Dairy Science

Overview

Upload Farm Details

Group Cows

Reap Benefits

Sample Farm: Total Cows = 470

Prices

	CP%	Nel, MCal/lb	\$(Unit)
Corn	10	0.9	6.72 (\$/bu)
Soybean Meal	50	0.88	350 (\$/ton)

Please note that the values highlighted with this color will be used by the tool.

	Calculated Values	
\$/lb CP	0.14337	Edit
\$/Mcal NEL	0.1174	Edit

Milk Price (\$/cwt)

Download Parameter Excel File (xls or xlsx version)

Download xlsDownload xlsx

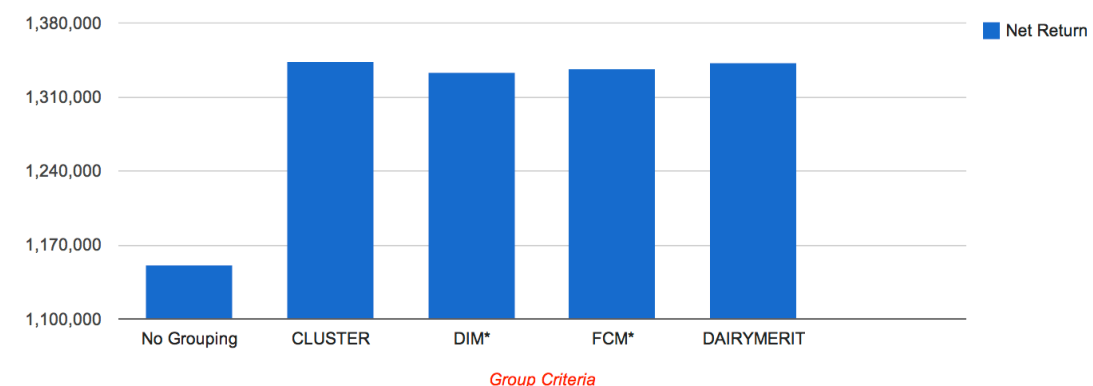
Upload Parameters as Excel File

Choose Fileno file selectedUpload

Current File/Data Status

Using Data from Default Parameters File on Server

© Dairy Management UW-Extension 2014



Group Criteria	Group Number	Number of Cows	NEL* (Mcal/lb)	CP* (%)
NO GROUPING (No Optimization)	1	470	0.82	18.00
	Mean		0.82	18.00
CLUSTER	1	270	0.71	16.05
	2	200	0.65	14.04
	Mean		0.68	15.20
DIM	1	200	0.72	16.19
	2	270	0.67	14.85
	Mean		0.69	15.42
FCM	1	270	0.71	16.03
	2	200	0.66	14.37
	Mean		0.69	15.33
DAIRYMERIT	1	270	0.71	16.05
	2	200	0.65	14.09
	Mean		0.68	15.22

Additional costs and benefits

Impacts grouping feeding strategies

Management cost

- Additional labor
- Extra management

Avoid costs

- Additives and supplements savings

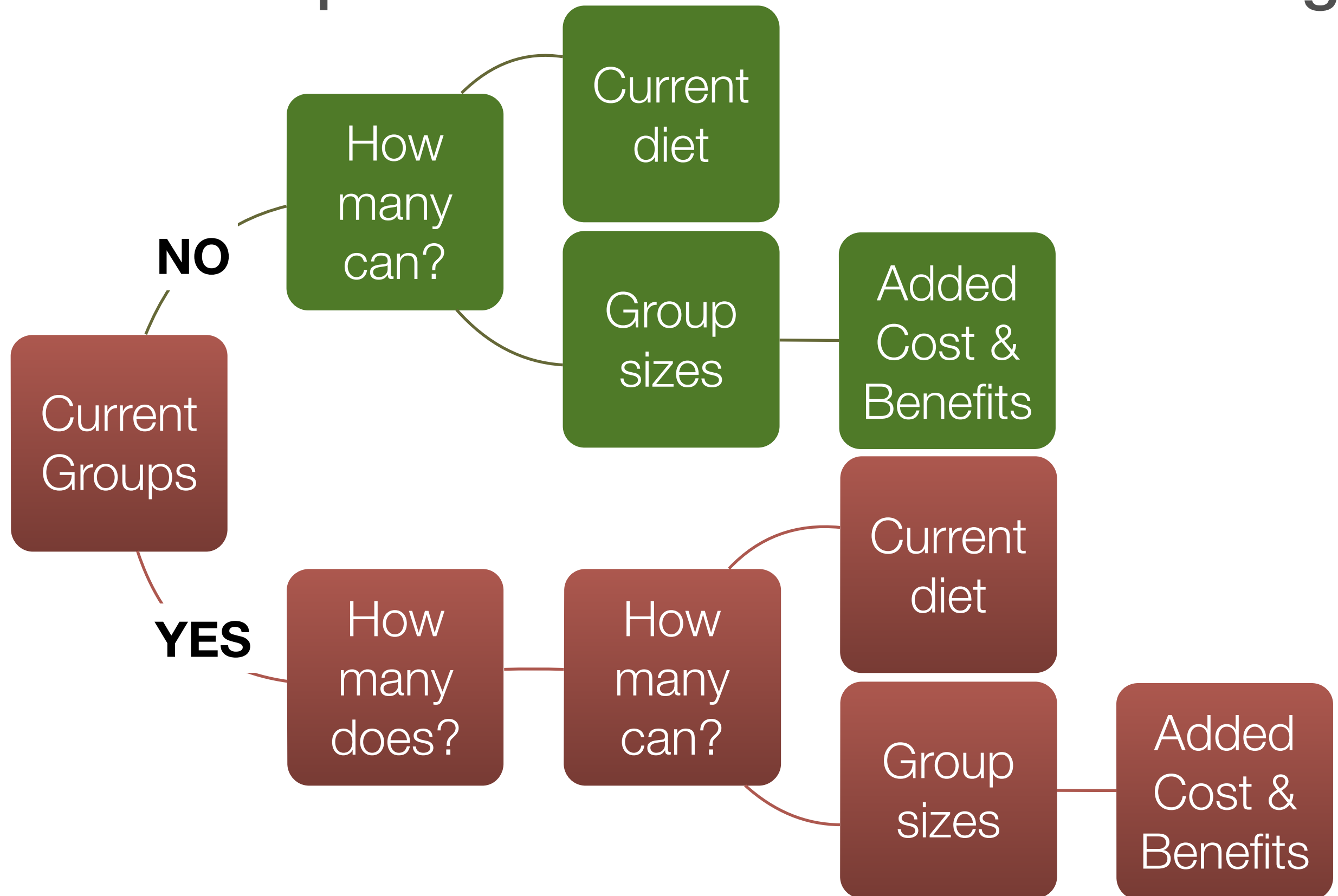
Milk depression

- Cow social interactions



Grouping Strategies

Farm/herd possibilities and decision-making





Tool demonstration

Grouping Illustration

Economic impact of nutritional grouping

Current Situation	
Lactating Cows	470
Current Groups	None
NEL Mcal/lb	0.80
CP, %	17



Possible Situation	
Groups	3
Group Sizes	100, 100, 270
Milk loss	2.27 kg/d x 4 d
Added Costs	\$1,000/month
Saved costs	None

Decision Support System Illustration

Cluster grouping criteria

Current Situation				
Group	Cows	NEL	CP	IOFC
	#	Mcal/lb	%	\$/cow.d
All	470	0.80	17.00	6.9



Possible Situation				
Group	Cows	NEL	CP	IOFC
	#	Mcal/lb	%	\$/cow.d
1	100	0.62	13.07	4.7
2	100	0.65	14.18	7.2
3	270	0.71	16.05	9.3
All	470	0.68	15.02	7.9

Wisconsin herds analysis



Analysis from dairy farm records

30 Wisconsin dairy farms

No grouping vs. 3 groups

- Same size groups

Grouping criterion

- Cluster



Same prices for all

- \$0.35/kg milk
- \$0.315/kg CP
- \$0.1174/Mcal NE_L

Projected body weight

- 500 kg primiparous
- 600 kg multiparous

Analysis from dairy farm records

30 Wisconsin dairy farms

Lactating cows (n=30)		1 Group	3 Groups	Gain
		Income Over Feed Cost \$/cow.yr		
Minimum	<200	697	1,059	161
Mean	788	2,311	2,707	396
Maximum	>1,000	2,967	3,285	580

**Increase of IOFC
(\$/cow per year)**

- Between 7 and 52%
- Mean = \$396
- Range = \$161 to \$580

Acknowledgements

**This project is supported
by Agriculture and Food
Research Initiative
Competitive Grant No.
2011-68004-30340 from the
USDA National Institute of
Food and Agriculture**



United States Department of Agriculture
National Institute of Food and Agriculture



Thanks